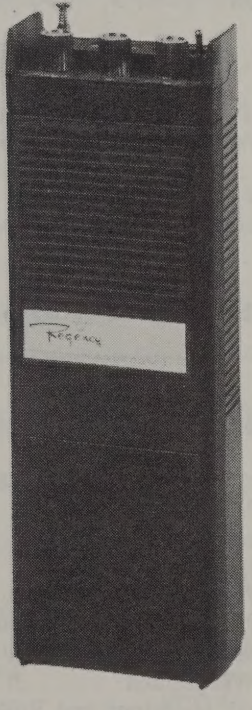
Regency ELECTRONICS INC.

SERVICE MANUAL



MODEL AQUACOM I

VHF-FM MARINE

PORTABLE TRANSCEIVER

7707 RECORDS STREET
INDIANAPOLIS, INDIANA 46226

PRINTED IN U.S.A.
1—75

PRICE $5.00
SM—10—502

CONTENTS

	Page
GENERAL DESCRIPTION	1
SPECIFICATIONS	1
Receiver	1
Transmitter	1
Power Requirements	2
General	2
Crystal Specifications	2
Channel Number Frequency	3
CRYSTAL INSTALLATION	3
OPERATION	4
BATTERY OPERATION	4
CIRCUIT DESCRIPTION	5, 6
Transmitter	5
Receiver	6
ALIGNMENT AND TUNING PROCEDURES	7-9
Receiver	7
Transmitter	8
Modulation Adjustments	8
PARTS LOCATION PHOTOS AND DIAGRAMS	10-14
Receiver Board, Top View	10
Transmitter Board, Top View	11
Parts Layout Diagram, Receiver Board	12
Parts Layout Diagram, Transmitter Board	13
Transistor Terminal Locations and Voltage Points, Receiver Board	14
Transistor Terminal Locations and Voltage Points, Transmitter Board	14
SCHEMATIC	15, 16
PARTS LIST	17-19
Receiver Printed Board Assembly	17
Transmitter Printed Board Assembly	18
Control Head Assembly	18
Cabinet Assembly	19

GENERAL DESCRIPTION

The Regency Aquacom I is a five-channel, all solid-state, hand-held narrow band FM Transceiver designed for use in the VHF Marine band.

The transmitter section is crystal controlled on all channels. Each channel's crystal has a trimmer capacitor for netting purposes. The transmitter employs frequency modulation by use of a varactor diode. An internal control is provided for adjusting the deviation from 0 to 7 KHz. The control is factory adjusted for 5 KHz deviation. Automatic deviation limiting is used to ensure system compliance with FCC Rules and Regulations.

The receiver section is also crystal controlled, utilizing miniature plug-in type crystals. A double conversion, super-hetrodyne receiver design employs two ceramic filters for optimum performance in areas of the country where numerous channels are closely grouped together.

Both the transmitter and receiver employs bandpass circuitry so that effective transmitter power and receiver sensitivity are maintained across the entire band (156.275-162.55 MHz). Silicon transistors are used for dependability, and three integrated circuits provide compactness and circuit reliability.

The receiver section is Certified under Part 15, Subpart C of the FCC Rules and Regulations. The transmitter is Type Accepted under Part 83 of the FCC Rules and Regulations.

NOTE

ONLY THOSE PERSONS PROPERLY LICENSED ARE PERMITTED TO MAKE REPAIRS OR ADJUSTMENTS.

The frequency of the transmitter should be checked periodically with a secondary frequency standard to insure proper and legal operation.

Best results will be obtained when adjusting the final RF output circuit if the antenna normally used is connected and the chassis is as nearly in the cabinet as possible.

Connect either a 50-ohm dummy load or the normally used antenna system.

SPECIFICATIONS

RECEIVER

Antenna Impedance	50 ohms
Frequency Range	156.275-162.550 MHz
Channels	5, Crystal Controlled
Crystals Installed	Channels 6, 16
Frequency Stability	.002%-10°C. to +60°C.
Sensitivity	0.5 μV, 20 DB Quieting
Selectivity	±7 KHz, 6 DB Down (max) ±20 KHz, 50 DB Down (min)
Spurious Rejection	55 DB
IF Filters	2, Ceramic
IF Frequencies	10.7 MHz, 455 KHz
Squelch System	"Noise" Operated
Modulation Acceptance	±7 KHz
Audio Output (16Ω Speaker)	.5 Watts (min)
Audio Distortion (At Rated Audio Power 3 KHz Deviation)	10% (max)
FCC Certified	Part 15, Subpart C

TRANSMITTER

Antenna Impedance	50 ohms
Frequency Range	156.275-157.425 MHz
Channels	5, Crystal Controlled with Frequency Netting Capacitors
Crystals Installed	Channels 6, 16
Power Output Hi Position Lo Position	 2 Watts (min) @ 14.4 VDC 1 Watt (max) @ 14.4 VDC
Frequency Stability	±.001% (-20°C. to +50°C.)
Emission Designator	16F3

Harmonic and Spurious Emissions Attenuation	46 DB (min)
Modulation	Frequency Modulation with Automatic Deviation Limiting
Deviation	±5 KHz, Factory Adjusted
Audio Distortion	Less Than 5% @ 3.0 KHz Deviation and 1 KHz Tone
Microphone (Internal)	16Ω Speaker
FCC Transmitter Type Accepted	Part 83

POWER REQUIREMENTS

Voltage Range	11-16 VDC
Current Requirements @ 14.4 VDC	
Receive - Squelched	30 ma (Typical)
Receive - Maximum Audio Output	80 ma (Typical)
Transmit - Hi Power	600 ma (Maximum)
Transmit - Lo Power	350 ma (Maximum)
Semiconductors	
Integrated Circuits	3
Silicon Transistors (Total)	22
Field Effect (FET)	1
Balanced Emitter Power (BET)	1
Diodes (Total)	6
Zener	2
Varactor	1
Signal	3

GENERAL

Size	3-5/16" W x 1-15/16" D x 9-3/4" H
Weight	1-1/2 lb.
Speaker	16Ω, 2-1/4", PM
Battery (Nickel-Cadmium)	14.4 VDC, 500 mah

CRYSTAL SPECIFICATIONS

Due to numerous frequencies or channels involved, only four crystals are installed by the factory. These channels are 6 and 16 (both transmit and receive). Other channels should be selected on the basis of specific usage requirements and will vary with locality. The miniature, plug-in crystals are simply installed by inserting them in the receptacles on the circuit board. Because of the accuracy required, Shepherd Industries' crystals are recommended. They are usually available at the source from which the transceiver was purchased. Specify exact frequency or channel number.

If desired, the crystals may be purchased from other manufacturers. The following information should be included in the order:

Receive Crystal

1. Crystal frequency, determined as follows:

$$\text{Xtal Freq.} = \frac{(\text{Receive Freq. MHz} - 10.7\ \text{MHz})}{3}$$

Example:

$$\text{Xtal Freq.} = \frac{156.300\ \text{MHz} - 10.7\ \text{MHz}}{3}$$

$$= \frac{145.600\ \text{MHz}}{3}$$

$$= 48.53333\ \text{MHz}$$

2. 3rd Overtone
3. Series Resonance - 600 Hz
4. Maximum equivalent series resistance: 35 ohms
5. Drive Level: 2 mw
6. Holder: HC-25/U
7. Frequency Calibration: ±.001% @ 25°C.
8. Frequency Tolerance: ±.002% from -10°C. to +60°C.

Transmit Crystal

1. Crystal frequency, determined as follows:

$$\text{Xtal. Freq.} = \frac{\text{Transmit Freq. (MHz)}}{12}$$

Example:

$$\text{Xtal Freq.} = \frac{156.300\ \text{MHz}}{12}$$

$$= 13.025\ \text{MHz}$$

2. Fundamental Mode
3. Load Capacitance: 32 pf
4. Maximum Series Resistance: 30 ohms
5. Drive Level: 2 mw
6. Holder: HC-25/U
7. Frequency Calibration: ±.001% @ 25°C.
8. Frequency Tolerance: .001% from -20°C. to +50°C.

NOTE: Transmit crystals that were manufactured for use with Regency's Marine radio series, including the Aquafone, MT-15, MT-15S, and MT-120 will operate properly in the Aquacom I.

Channel No. Frequency

Table I lists all of the channels currently in use and shows each channel's transmit and receive frequency for the use of recreational vessels. Table II lists those channels for the use of commercial vessels.

TABLE I

VHF-FM Channels Available for the Use of Recreational Vessels

Channel Number	Frequency(MHz)	
	Transmit	Receive
06*	156.300	156.300
09	156.450	156.450
12	156.600	156.600
13	156.650	156.650
14	156.700	156.700
15	--	156.750
16*	156.800	156.800
17	156.850	156.850
20	157.000	161.600
22	157.100	157.100
24	157.200	161.800
25	157.250	161.850
26	157.300	161.900
27	157.350	161.950
28	157.400	162.000
65	156.275	156.275
66	156.325	156.325
68	156.425	156.425
69	156.475	156.475
70	156.525	156.525
71	156.575	156.575
72	156.625	156.625
73	156.675	156.675
74	156.725	156.725
78	156.925	156.925
84	157.225	161.825
85	157.275	161.875
86	157.325	161.925
87	157.375	161.975
W1 **	--	162.550
W2 **	--	162.400

* Mandatory Channels

** W1 may also be identified as WX or WX1.
W2 may also be identified as WX2.

TABLE II

VHF-FM Channels Available for the Use of Commercial Vessels

Channel Number	Frequency(MHz)	
	Transmit	Receive
06*	156.300	156.300
07	156.350	156.350
08	156.400	156.400
09	156.450	156.450
10	156.500	156.500
11	156.550	156.550
12	156.600	156.600
13	156.650	156.650
14	156.700	156.700
15	--	156.750
16*	156.800	156.800
17	156.850	156.850
18	156.900	156.900
19	156.950	156.950
20	157.000	161.600
22	157.100	157.100
24	157.200	161.800
25	157.250	161.850
26	157.300	161.900
27	157.350	161.950
28	157.400	162.000
65	156.275	156.275
66	156.325	156.325
67	156.375	156.375
73	156.675	156.675
74	156.725	156.725
77	156.875	156.875
79	156.975	156.975
80	157.025	157.025
84	157.225	161.825
85	157.275	161.875
86	157.325	161.925
87	157.375	161.975
88	157.425	157.425
W1 **	--	162.550
W2 **	--	162.400

* Mandatory Channels

** W1 may also be identified as WX or WX1.
W2 may also be identified as WX2.

CRYSTAL INSTALLATION

Prior to installing the crystals, the rear cover and front cover (speaker grille) will have to be removed. Remove the four bolts that fasten the front cover to the rear cover. Position the unit on a workbench or table with the front cover down. This will prevent the front cover from dropping away and possibly pulling loose the speaker wires connected to the Printed Circuit Board.

The channel positions for both the receive and transmit crystals start at the bottom of the unit with the top pair of socket pins being Channel 5. See Figs. 3 and 4.

To install a RECEIVE crystal, carefully remove the rear cover by lifting the cover straight off the unit. Insert the crystal or crystals in the proper socket pins. Be sure to push crystal all the way in the socket pins to provide adequate clearance from the cover. If no transmit crystals are to be installed, replace the rear cover and four bolts. Do not overtighten these bolts.

To install a TRANSMIT crystal, turn the unit over and place the front cover along side of the unit. Insert the crystal or crystals in their appropriate socket pins. For each transmit crystal there is a variable capacitor that is to be used for "netting" (adjusting to the exact frequency) the transmit crystal. The netting should be made with an accurate frequency counter on a yearly schedule by a properly licensed technician holding either a First or Second Class FCC license.

OPERATION

VOLUME CONTROL/OFF-ON SWITCH

This control varies the audio output level for the internal speaker and also at the external earphone jack. Clockwise rotation turns the receiver on and increases the volume or audio output.

SQUELCH CONTROL

This control is used to eliminate background noise in the absence of a signal. Full clockwise rotation removes all squelch action. Turning the control counterclockwise until noise disappears permits the receiver to be "quiet" (no audio output) until an actual signal is received. The dynamic range of the Squelch control from threshold to full CCW is approximately 8 DB. If the Squelch control is set fully counterclockwise, the receiver will still operate properly and not be locked out.

CHANNEL SELECTOR

This is a five-position rotary switch which enables the operator to select any one of five crystal-controlled, transmit-receive channels. Each switch position pairs up a specific transmit crystal with its respective receive crystal.

PTT SWITCH

The PTT (push-to-talk) switch is the large circular pushbutton located on the left side of the unit. Merely depress this button and talk directly into the receiver's internal speaker whenever a transmission is desired.

LOW-POWER SWITCH

This switch provides the operator with the capability of selecting either one of two RF output power levels. With the switch in the high position (bat handle down), the transmitter will develop its full rated power output. With the switch in the Low Power position, the transmitter's output is limited to approximately 1 watt. This power level is required for in-harbor use.

ANTENNA

The internal, telescoping antenna should be fully extended for optimum receiver and transmitter performance. When an external antenna is used, the internal antenna is automatically disconnected. Thus, it may be either extended or collapsed without degrading the transceiver's performance.

EXTERNAL ANTENNA

If desired, an external antenna can be used instead of the internal one. The external antenna should be adjusted for 50 ohms impedance and fed with 50 ohm coaxial cable. The external antenna jack will accept most miniature (3.5mm) phone plugs.

EXTERNAL POWER

An external DC power supply can be used by inserting a coaxial type jack into the receptacle labeled EXT. PWR. This power connector will accept any coaxial jack with an I.D. of .08 inches (approximately 2mm). The outer metal sleeve should be connected to the positive lead and the inner sleeve (or tube) connected to the negative (or ground) lead. The external supply should not exceed 16 VDC, with 14.4 VDC as the recommended voltage for continual usage.

EXTERNAL EARPHONE

To use an external earphone, such as Regency's MA-52, merely plug it into the sub-miniature jack located on top of the unit and labeled EP. When an external earphone is plugged in, the internal speaker is automatically disconnected.

BATTERY OPERATION

If battery replacement is required, it is recommended that a 14.4 volt Nickel-Cadmium battery, such as Regency's MA-50, be used.

BATTERY CHARGING

It is recommended that Regency's Battery Charger BC-101 be used to charge the battery. Place the Aquacom I in the well of the charger with the speaker grill facing toward the front of the charger. This will automatically position the two contacts on the battery so that they properly mate with the BC-101's charging terminals.

A Ni-Cad battery that reads only 12 to 13 VDC with the receiver turned on and unsquelched should be charged 14 to 16 hours with the BC-101 set to NORM. If the battery is fully charged, or reads over 14.4 VDC when transmitting, place the BC-101 switch to the TRICKLE position. The unit may be charged at the trickle rate indefinitely with no harmful effect either to the battery or to the charger.

NOTE: The Aquacom I may be used while the battery is being charged. With the BC-101 set to NORMAL, the battery will be charged at approximately the trickle rate.

CIRCUIT DESCRIPTION

GENERAL

The function of each stage or section is explained in conjunction with the block diagrams (Figs. 1 and 2) and the schematic (Fig. 13).

TRANSMITTER

When the push-to-talk button is pressed, the antenna is switched from the receiver to the transmitter output. The speaker (microphone) is switched from the output of the receiver to the input of the modulator circuit. This also applies power to the transmitter circuit through switching transistor Q208, and activates the transmitter.

Audio Section

Audio speech is converted to an electrical signal by the 16-ohm speaker. This signal is applied to IC201 through a 6 DB per octave de-emphasis network and is then amplified. Bias to IC201 is adjusted by the Clip Adj. R218 which adjusts the clipping symmetry of the signal as it passes through IC201. Deviation Adj. R215 adjusts the audio signal level fed to the modulator and is set for maximum system deviation of 5 KHz. This signal is then passed through a low pass filter which limits audio sideband splatter of the transmitted signal.

The signal is then fed to varactor CR202 which FM modulates the crystal oscillator when audio signal is present. A varactor Bias Adj. R225 is used to adjust the varactor to nominal capacity for the crystal oscillator.

Crystal Oscillator

The Oscillator Q204 is a common collector, modified colpitts type, whose frequency is determined by one of five crystals selected by the Channel Selector switch. Each crystal has an associated trimmer capacitor which is used for fine frequency adjustment. The primary supply voltage to the oscillator is regulated.

Frequency Multiplier

The oscillator frequency (approximately 13 MHz) is multiplied by twelve in the multiplier section to form the carrier output frequency. The frequency is multiplied by Q204, oscillator-tripler; Q203, Doubler; Q202, Doubler. A double-tuned, inductively-coupled circuit at the output of Q204 and Q203 selects the desired harmonic and provides for impedance matching. The output of Q202 is capacitively coupled and provides the desired selectivity as well as impedance matching.

Power Output

Power Amplifier

The Power Amplifier (Q201) stage amplifies the carrier signal to the required output power. Additional selectivity against spurious emissions is provided in the output matching network.

Output Matching Network

Coils L201, L202, and capacitors C201, C202, C203, and C204 make up an output matching network which

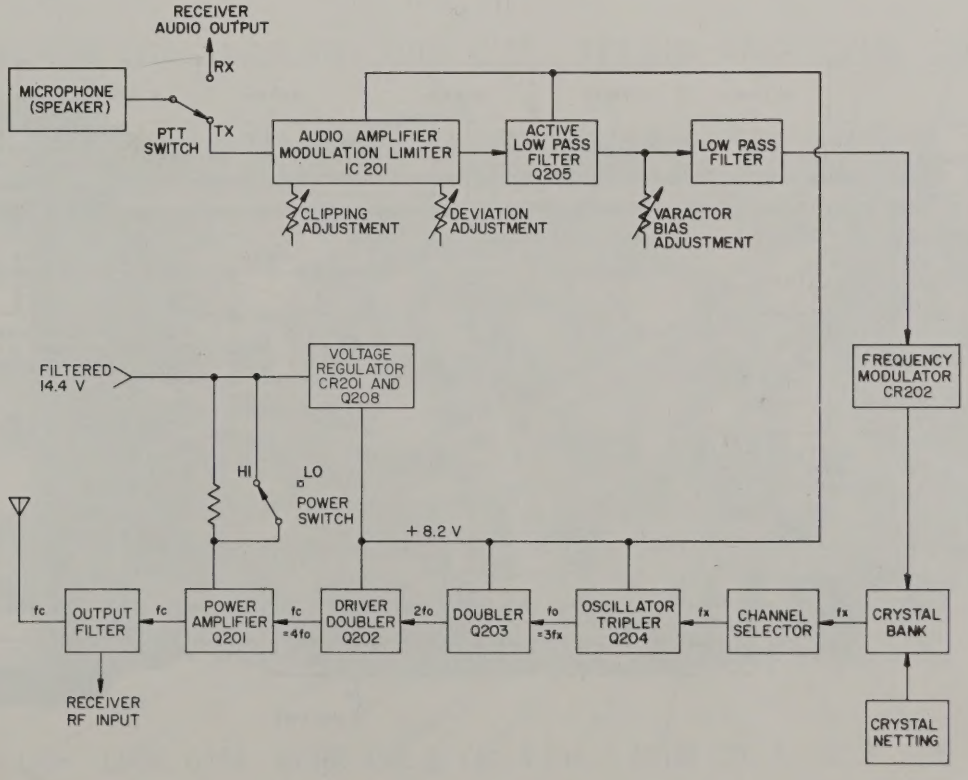


Fig. 1. Transmitter Block Diagram.

transforms the output impedance of Q201 to a 50 ohm resistive match at the antenna. This circuit also provides selectivity which attenuates the harmonics of the carrier. RF choke L203 isolates the RF output of Q201 from the DC supply bus.

Low Power Provision

The Hi-Lo power switch on the front panel limits the RF power output of the transmitter to less than one watt in the "Lo" position while allowing normal full power to be developed in the "Hi" position. In the "Lo" position, resistor R201 is switched in series with the power supply to Q201 to act as a current limiter. By limiting the supply voltage to the Power amplifier, the maximum power output is reliably controlled under all conditions.

RECEIVER

Front End

Transistor Q101 is an RF amplifier with broad-tuned circuits in its input and output circuitry. The output of the RF amplifier is capacitively coupled to the input of the Mixer, Q102, a field effect transistor. The First Local Oscillator, Q103, uses third overtone crystals. The tuned circuit of L105 and C115 resonates at the third harmonic of the crystal frequency and is capacitively coupled to the First Mixer, Q102, through C119.

First Mixer–10.7MHz IF

The output frequency of the FET Mixer is tuned to 10.7 MHz by L104, C108, and C109. This output is filtered by a 10.7 MHz ceramic filter, CF101, which allows the signal to pass, but attenuates spurious signals.

Second Mixer–455 KHz IF

The output of the 10.7 MHz ceramic filter is fed to an integrated circuit, IC101, which contains the second mixer circuitry, the second local oscillator circuitry operating at 10.245 MHz, and is crystal controlled by Y106.

The 455 KHz output of IC101 (terminal 5) is coupled through a tuned circuit to the input of ceramic filter, CF102, which is a narrow-band filter centered at 455 KHz. The excellent band-pass characteristics of CF102 provides very good adjacent channel rejection. The output of CF102 is coupled to the input of a 455 KHz amplifier, Q104. The output of Q104 is then coupled through a tuned circuit to the input of the integrated circuit IC102. Integrated circuit, IC102, is a series of amplifiers providing approximately 60 DB gain at 455 KHz. Also included in IC102 is the limiting circuitry and a quadrature detector circuit. Coil L110, connected between terminals 2 and 12 of IC102, is the adjustable quadrature coil.

Audio and Squelch

The audio output from IC102 (terminal 1) is coupled to the input of the Audio amplifier circuit and the noise-operated squelch circuit.

Transistor Q105 is an amplifier whose frequency response extends from approximately 5 KHz to 25 KHz. Q105 amplifies the "noise" occurring in this frequency range, which is coupled to the base of Q106, used as a detector, which rectifies the amplified noise and produces DC at its collector.

When the DC voltage at the collector of Q106 is positive and of sufficient value to provide base bias for Q107, Q107 turns on and provides essentially a short

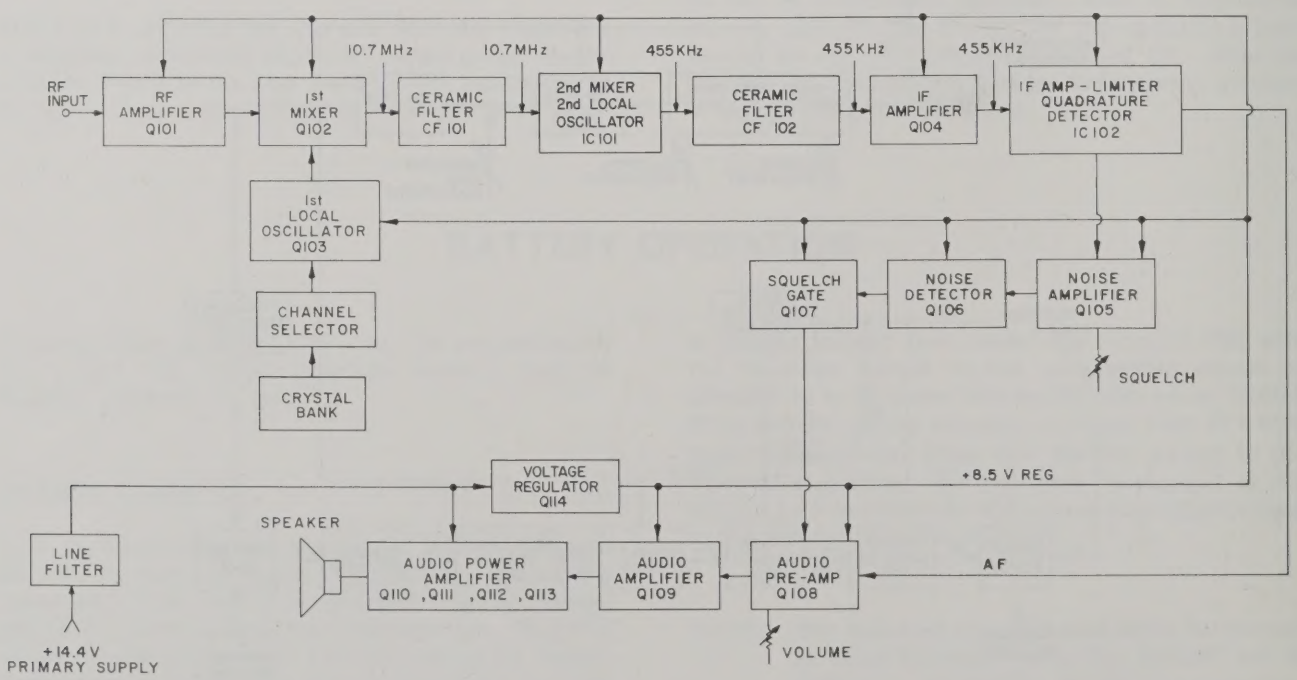


Fig. 2. Receiver Block Diagram.

circuit between the base of Q108 and ground. This action turns off Q108 and the audio output from the receiver is squelched (muted).

When a signal (carrier) arrives, the noise input to the detector, Q106, is reduced to the point where the DC voltage at the base of Q107 is no longer sufficient to cause Q107 to conduct. At this time, Q108 is allowed to conduct normally and the audio output is heard.

With the Audio preamplifier Q108 operating normally, audio is applied through the Volume control to the base of Audio amplifier Q107 which supplies a signal to Audio Drivers Q110 and Q111. The output transistors, Q112 and Q113, form a quasi-complementary, transformerless stage capable of delivering .5 watts to the speaker.

ALIGNMENT AND TUNING PROCEDURES

RECEIVER ALIGNMENT

During all steps of receiver alignment, the squelch control should be in the maximum clockwise position (minimum squelch action).

Set power supply source to maintain a voltage of 14.4 VDC.

Align receiver to channel nearest the center of the frequency range in the band over which they will operate.

Equipment Required

FM Signal Generator
AC VTVM
DC VTVM

Procedure (Refer to Fig. 3)

1. Preset the following coil cores as measured from top of coil form:

   L100 (Yel) - 1 turn
   L101 (Org) - 4-1/2 turns
   L102 (Vio) - 4-1/2 turns
   L103 (Yel) - 3 turns
   L104 (Red) - 2 turns
   L105 (Org) - 3-1/2 turns
   L110 (Grn) - 4 turns

2. Connect AC voltmeter from TP3 to ground. Turn on On-Off control and adjust Volume control R1 for a readable output level on the 1-volt scale.

3. Connect DC probe of VTVM to test point TP1 (pin 1 of IC102), common lead to ground. Adjust L110 for MAXIMUM audio (noise) output. Voltage should measure approximately 3.8 volts.

4. Connect AC voltmeter to test point TP3. Adjust L104 for MAXIMUM audio output. Continuously vary Volume control (R1) for mid-scale reading on AC voltmeter.

5. Connect DC probe of VTVM to test point TP2, common lead to ground. Adjust L105 and L103 (in that order) for maximum reading (typical .75 VDC).

6. Connect FM Signal Generator to Ext. Ant. input jack (J1) and tune to center frequency of channel

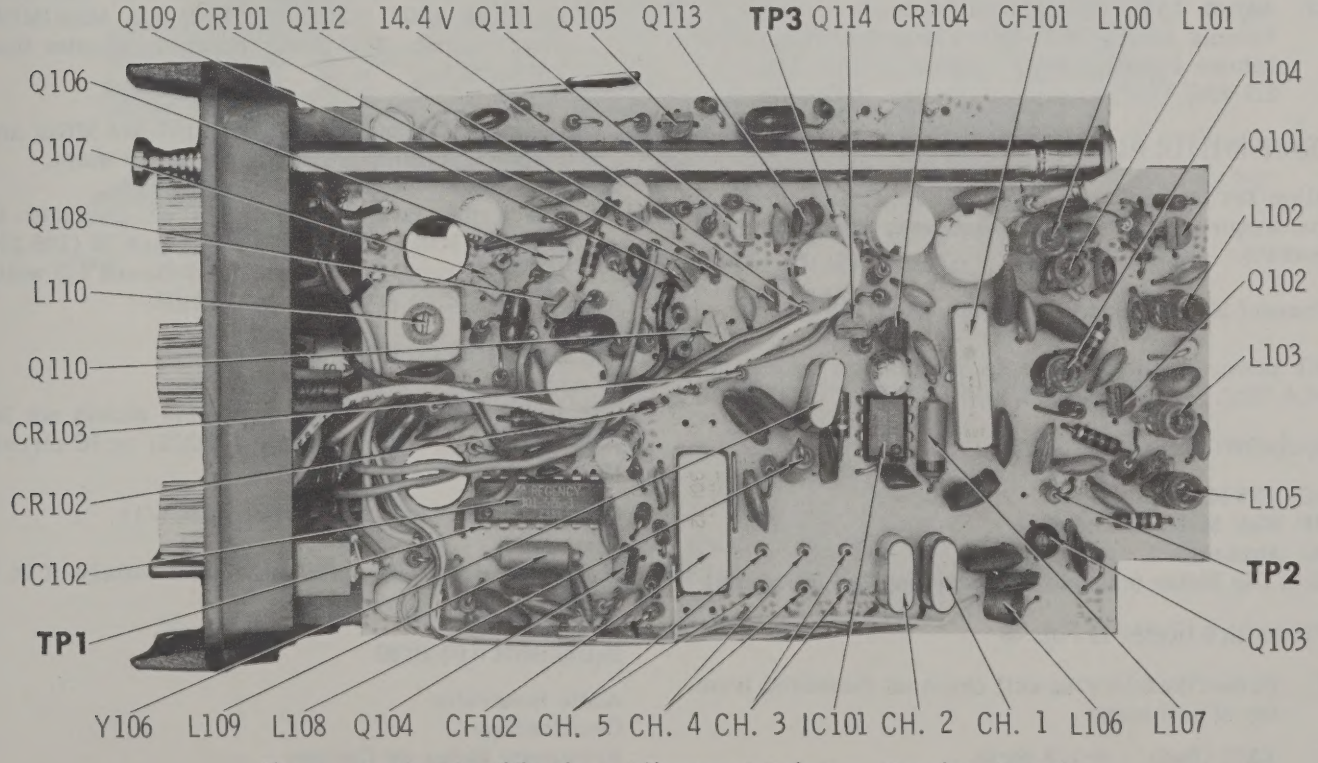


Fig. 3. Parts Identification, Alignment Points – Receiver Board.

being used for alignment. Adjust RF level until audio output decreases about 5 DB as indicated on AC voltmeter connected to test point TP3. Readjust FM Signal Generator and/or audio level to maintain a reading on the 1-volt scale.

7. Adjust L102, L101, and L100 for MINIMUM audio output reading.

8. Set FM Signal Generator to zero signal output. Adjust Volume control (R1) for 1-volt reading on AC voltmeter. Increase RF level of generator until a reading of .1V is obtained on AC voltmeter. This is the 20 DB quieting point, and should not exceed .5μV signal input.

9. Tune FM Signal Generator to 910 KHz image frequency (910 KHz below the frequency being used). Adjust signal level for 20 DB quieting (.1 volt).

10. Adjust L104 for MAXIMUM reading on AC voltmeter. Readjust generator output for 20 DB quieting (.1 volt). The Signal Generator signal level should be 55 DB greater than the level measured in Step 8.

11. Set RF level of generator to zero output and adjust Volume control (R1) for 1 volt reading on AC voltmeter.

12. Increase RF level of generator for 20 DB quieting as in Step 8.

13. Readjust L102 for MINIMUM reading on AC voltmeter.

14. Apply a 1 KHz signal modulated at approximately 3 KHz deviation. Set output level of generator at 1000 μV.

15. Adjust L110 for MAXIMUM audio output. Set Volume control (R1) fully clockwise. The output volume reading on AC voltmeter should exceed 2.9 VAC.

TRANSMITTER ALIGNMENT

Align the transmitter using channel nearest center of the frequency range in the band over which they will operate.

Connect 50 ohm load to Ext. Ant. jack (J1).

Set power supply source to maintain a voltage of 14.4 VDC.

Equipment Required

DC VTVM
RF Watt Meter (50 ohm)
DC Ammeter
Grid Dip Meter (capable of measuring 2nd harmonic)

Procedure (Refer to Fig. 4)

1. Preset the following coil cores as measured from top of coil form:

   L201 (Red) - 4-1/2 turns
   L202 (Red) - 2-1/2 turns
   L205 (Org) - 3-1/2 turns
   L206 (Brn) - 5 turns
   L207 (Grn) - 5-1/2 turns
   L208 (Grn) - 7 turns
   L209 (Blk) - 2-1/2 turns
   L210 (Blk) - 1 turn

2. Set Channel Selector to channel being used for alignment.

3. Connect DC probe of VTVM to test point TP5 (B+), common lead to test point TP4 (junction of R204 and C216). Set VTVM on 5-volt scale.

4. Key transmitter and adjust L210 and L209 for MAXIMUM reading on VTVM. Voltage should be 3 VDC, ±1V.

5. Connect DC probe of VTVM to test point TP5, common lead to test point TP6 (junction of R202 and C211). Set VTVM to 1.5-volt scale.

6. Adjust L208 and L207 for MAXIMUM reading on VTVM. Voltage should be 1.0 VDC, ±.5V.

7. Connect RF Watt Meter to Ext. Ant. jack (J1). Adjust L206, L205, L202, and L201 for MAXIMUM power output. Power should be greater than 2.0 watts.

8. Loosely couple a grid-dip meter to transmitter output circuitry. Meter must be capable of reading the 2nd harmonic frequency of channel being used for alignment.

9. Adjust L201 for MAXIMUM attenuation (minimum amplitude) of the 2nd harmonic.

10. Repeat Steps 2 through 6 to make sure the transmitter is properly aligned.

11. Connect RF Watt Meter to Ext. Ant. jack (J1). Readjust L206, L205, and L202 for MAXIMUM power output. The power should be greater than 2.0 watts.

12. Check power on channels 88 (157.425 MHz) and 65 (156.275 MHz) for minimum of 2.0 watts.

13. Check the Low Power switch on channels 16 (156.800 MHz), 88 (157.425 MHz), and 65 (156.275 MHz). Power output should not exceed 1.0 watts and should be greater than .5 watts.

MODULATION ADJUSTMENTS

The following modulation adjustments should not be attempted unless the Varactor (CR202) or IC circuit (IC201) has been replaced.

Connect 50 ohm load to Ext. Ant. jack (J1).

Set power supply source to maintain a voltage of 14.4 VDC.

Equipment Required

Audio Generator
Oscilloscope
Frequency Meter or Counter
Deviation Meter

Procedure (Refer to Fig. 4)

1. Connect DC probe of VTVM to test point TP8, common lead to ground. Set VTVM to 5-volt scale.

2. Adjust Bias Adj. (R225) for 4 VDC.

3. Loosely couple Frequency Meter to output of transmitter circuitry. Set Channel Selector to position 2 (Ch. 16).

4. Key transmitter and adjust C226 for 156.800 MHz, ±.0001 MHz.

5. Connect an Oscilloscope to test point TP7 (pin 2 of IC201). Connect Audio Generator to speaker input. Use a resistive pad to match the Audio Generator output impedance to the input impedance of circuit.

6. Set Audio Generator to 1000 Hz signal and adjust level for 30 millivolts AC.

7. Key transmitter and adjust Clip Adj. (R218) for symmetrical clipping on both positive and negative peaks.

8. Connect Deviation meter to transmitter output circuitry.

9. Key transmitter and adjust Dev. Adj. (R215) for 5 KHz deviation as observed on Deviation Meter. Counterclockwise rotation increases deviation.

10. Loosely couple Frequency Meter to output of transmitter circuitry.

11. Key transmitter and check all 5 channel-netting capacitors using the Channel 16 crystal. All positions should be capable of being netted on frequency of 156.800 MHz, ±100 Hz.

12. Insert other channel crystals and repeat Steps 10 and 11, adjusting the corresponding netting capacitor for the channel frequencies being used.

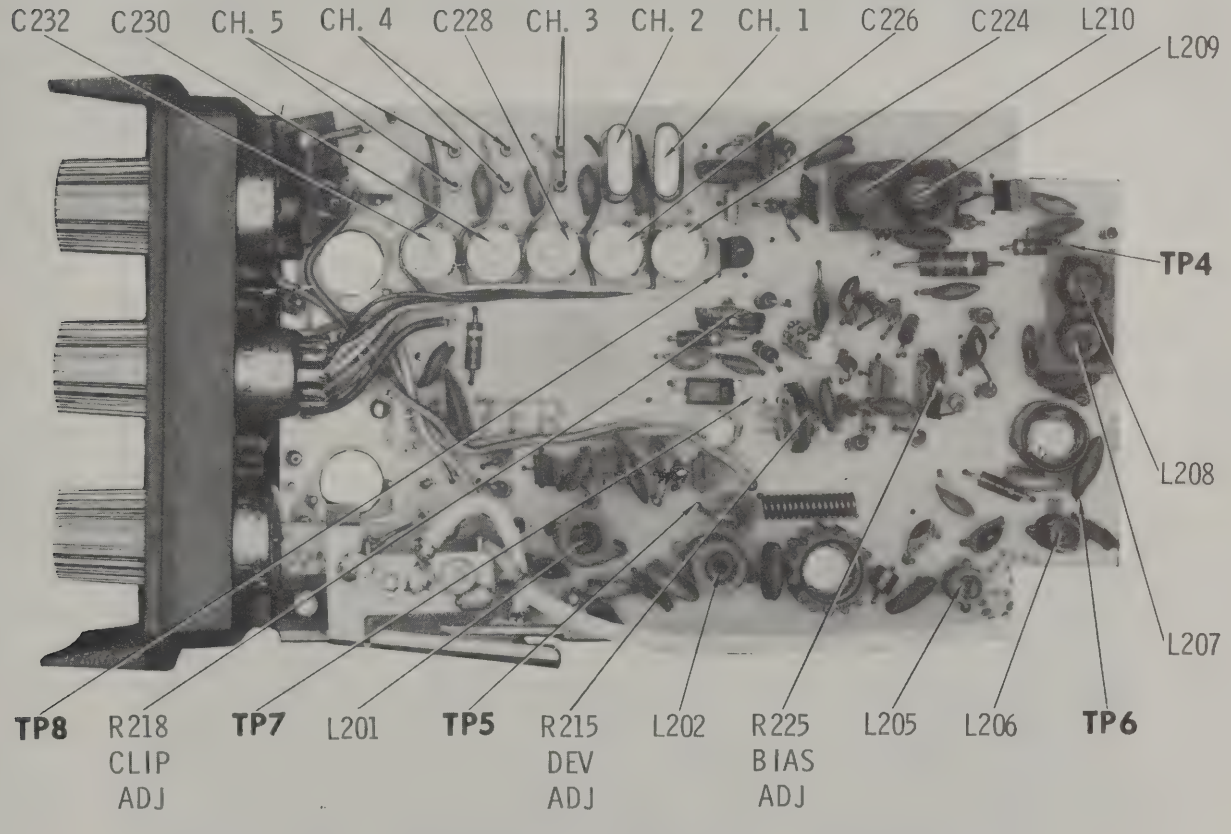


Fig. 4. Parts Identification, Alignment Points — Transmitter Board.

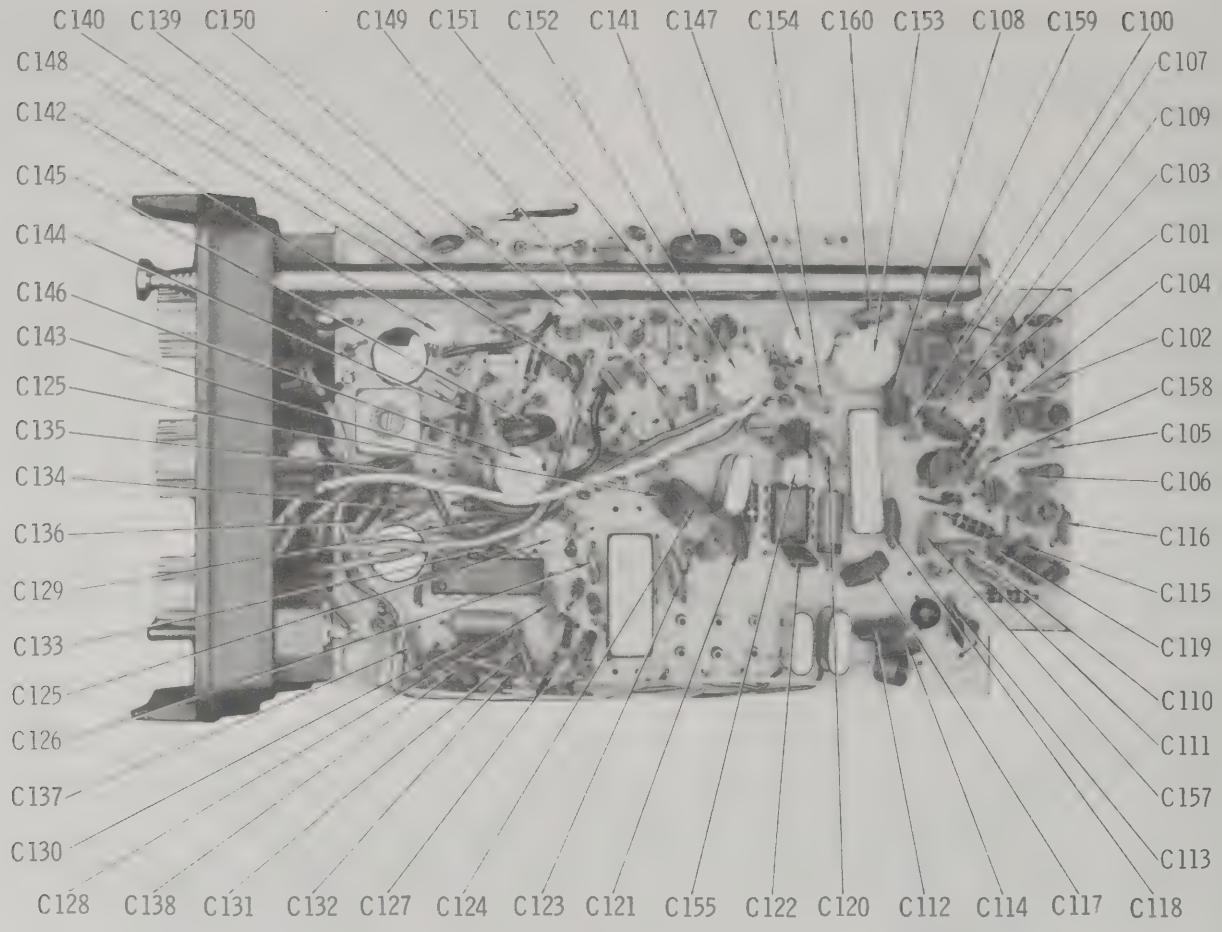


Fig. 5. Parts Identification, Receiver Board — Top View.

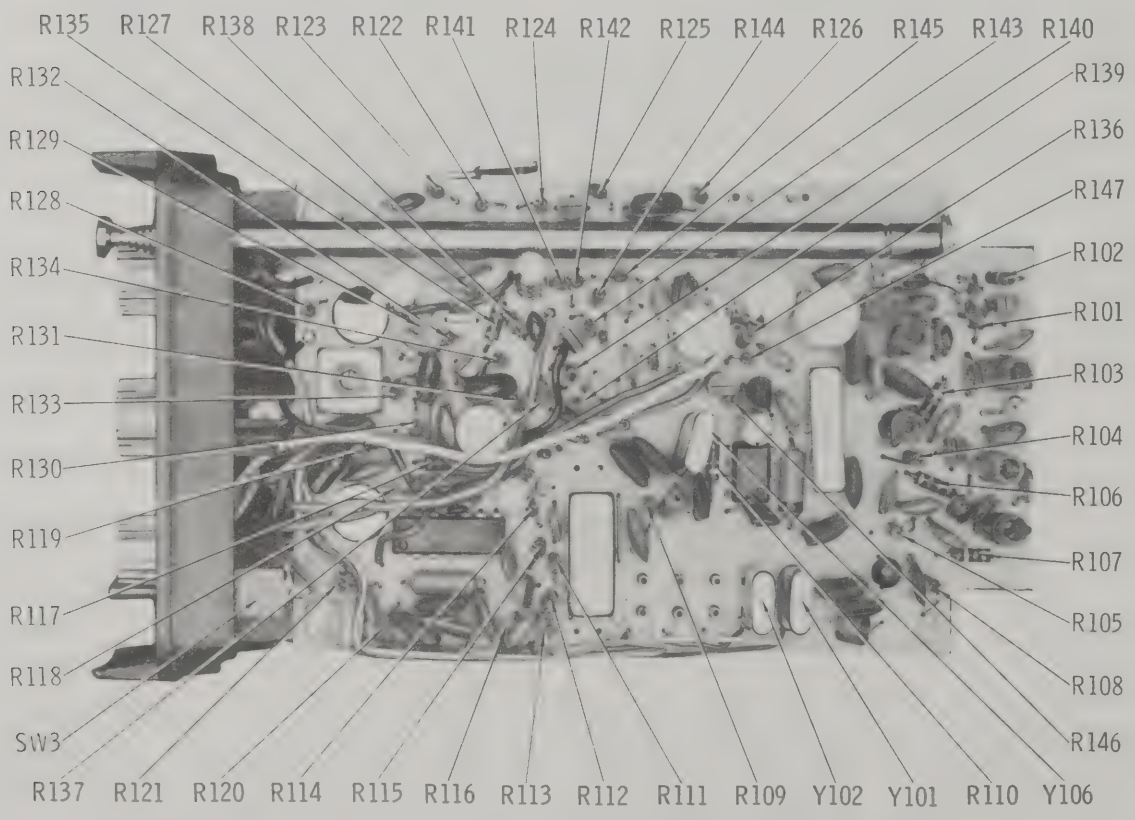


Fig. 6. Parts Identification, Receiver Board — Top View.

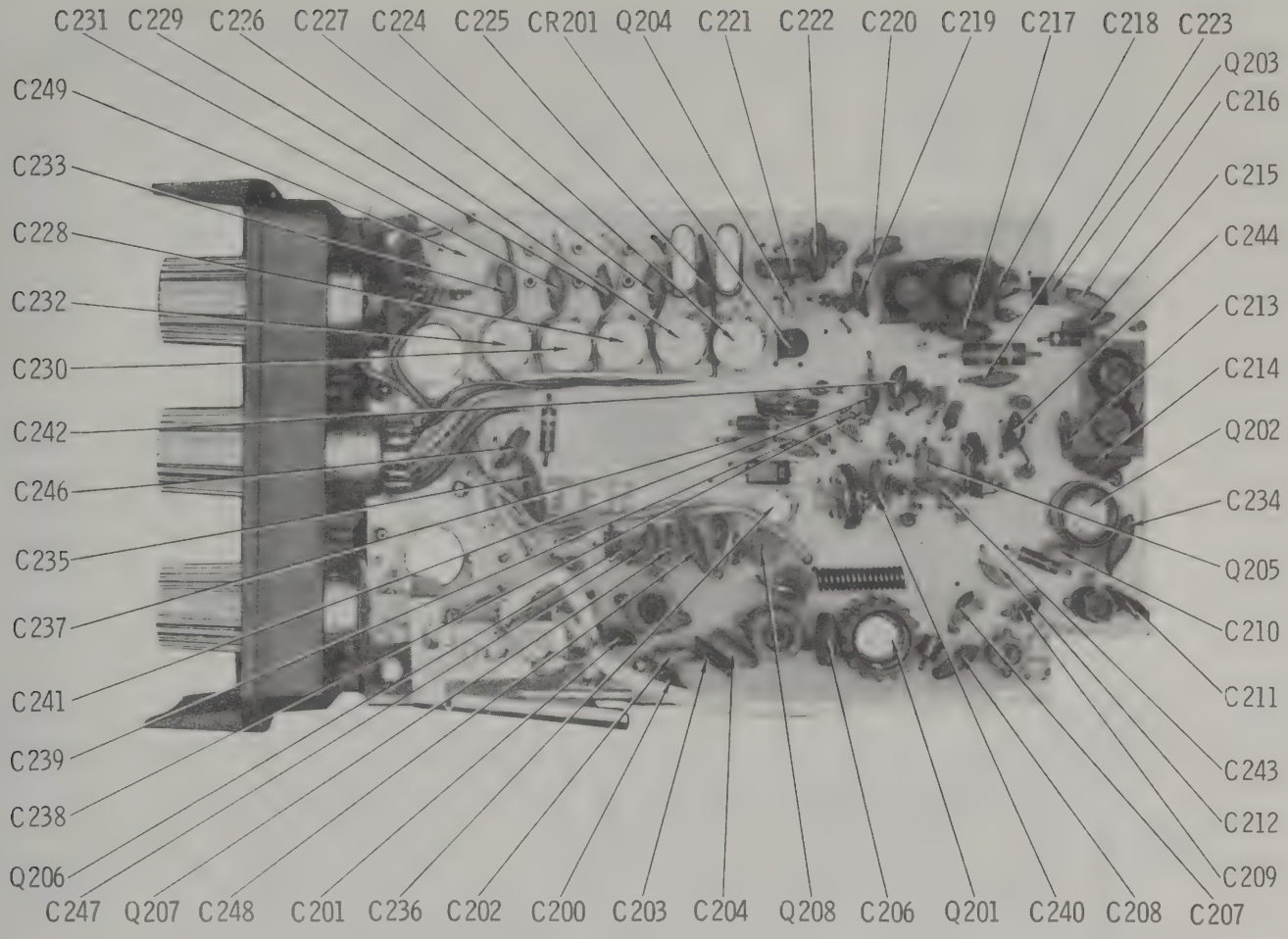


Fig. 7. Parts Identification, Transmitter Board — Top View.

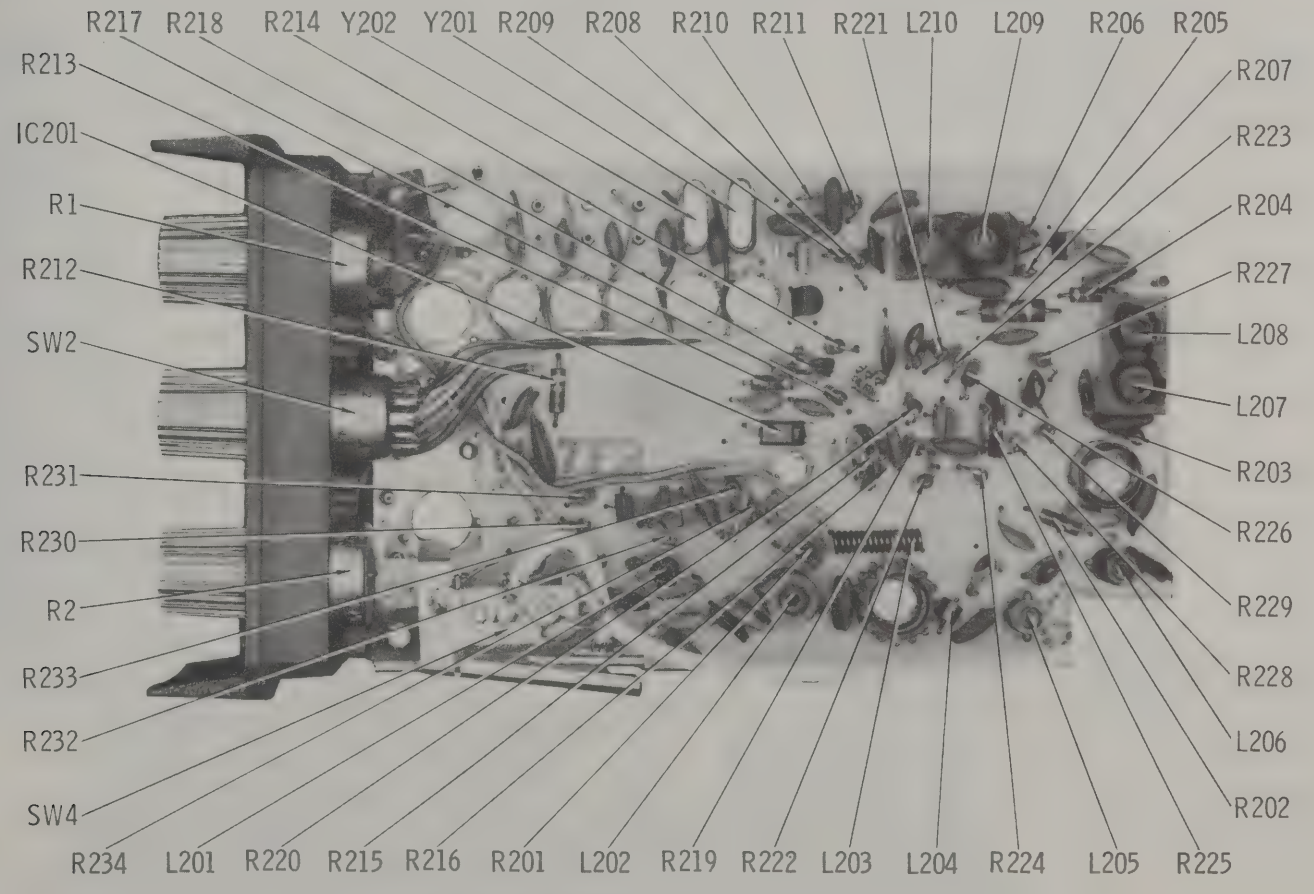


Fig. 8. Parts Identification, Transmitter Board — Top View.

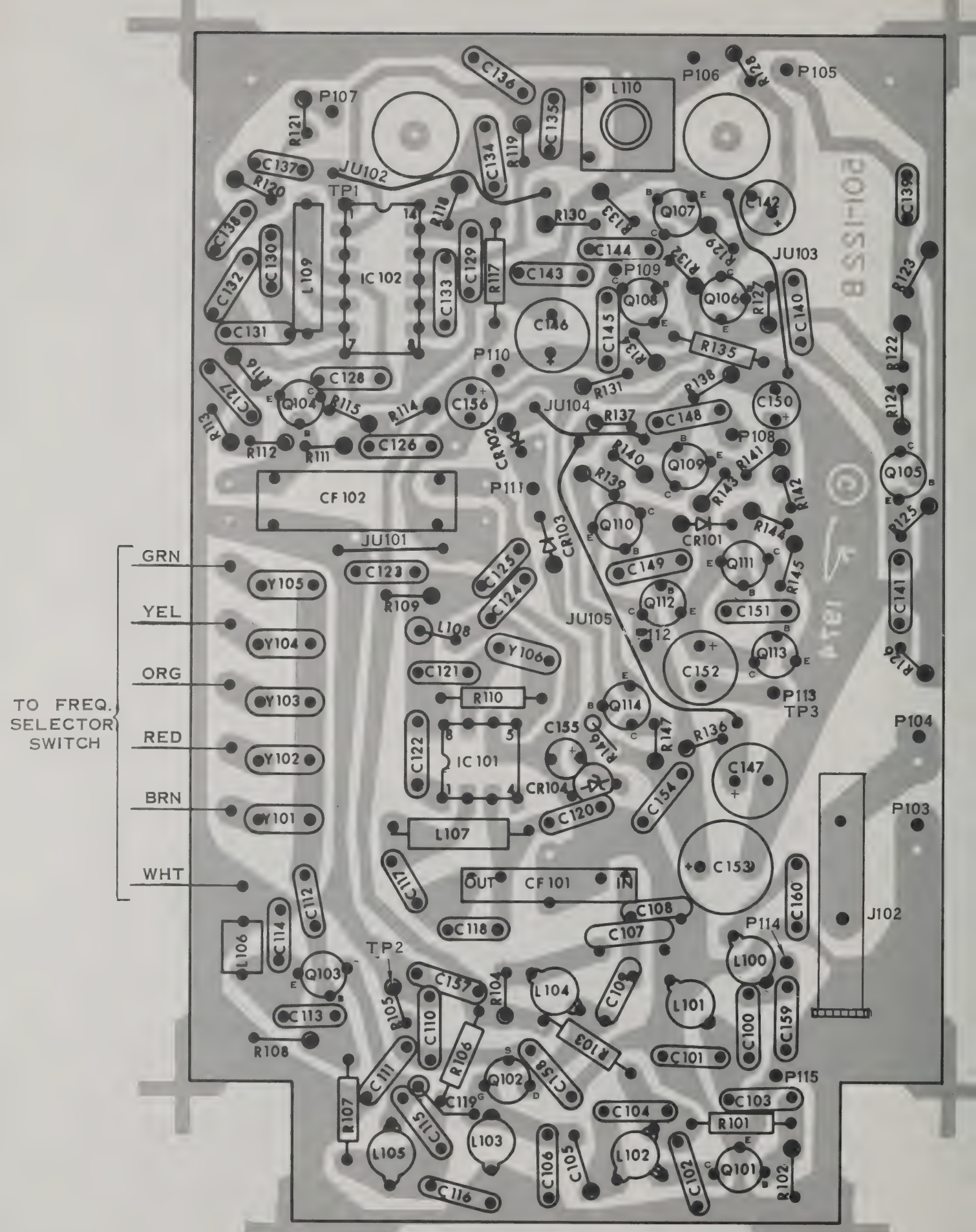


Fig. 9. Parts Layout Diagram – Receiver Board.

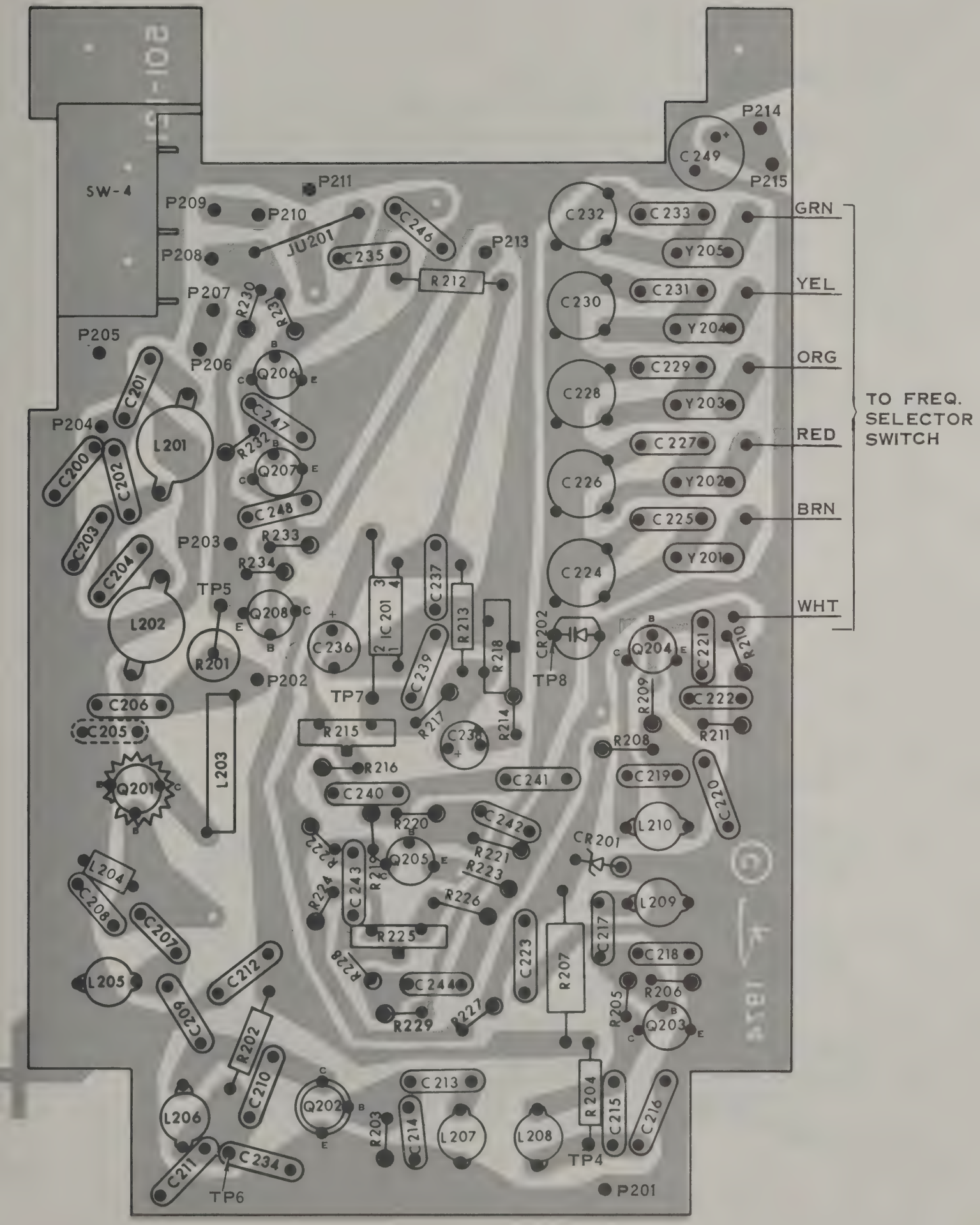


Fig. 10. Parts Layout Diagram — Transmitter Board.

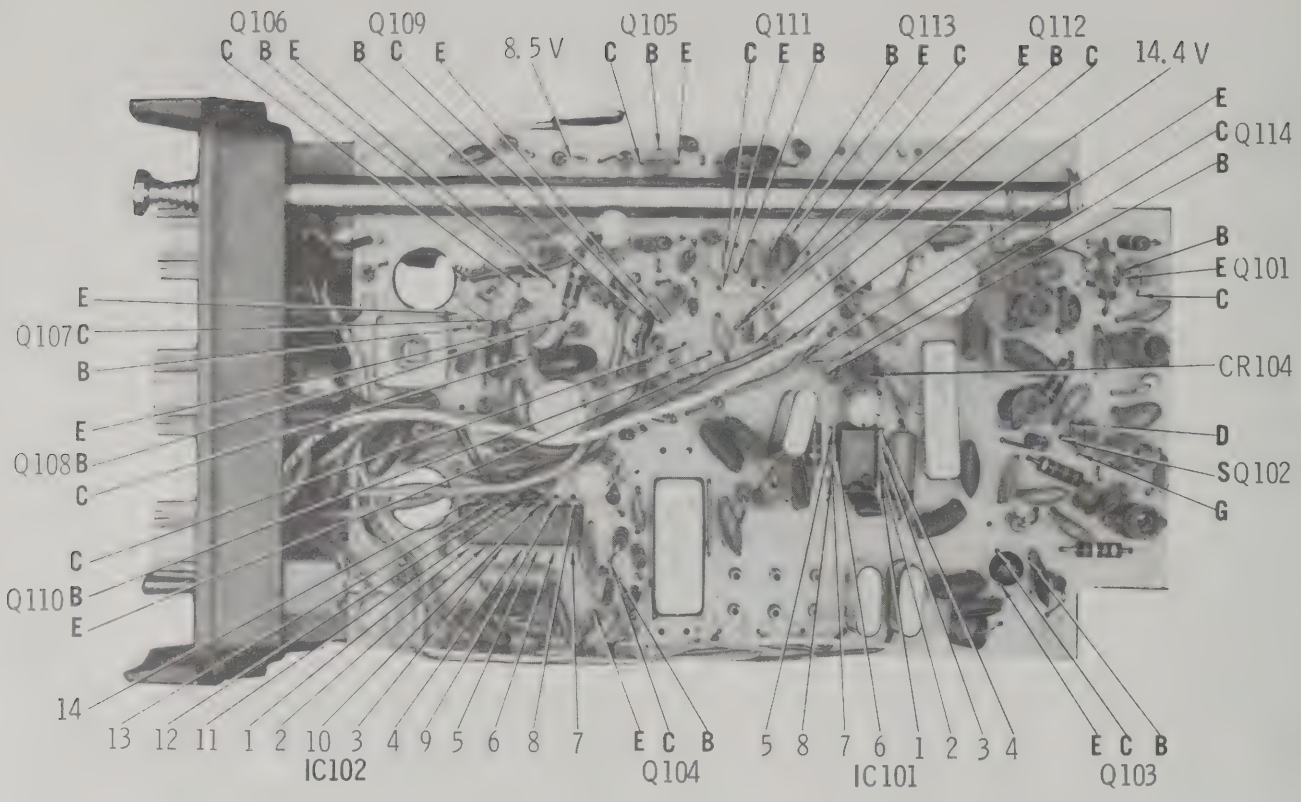


Fig. 11. Transistor Terminal Locations and Voltage Points — Receiver Board.

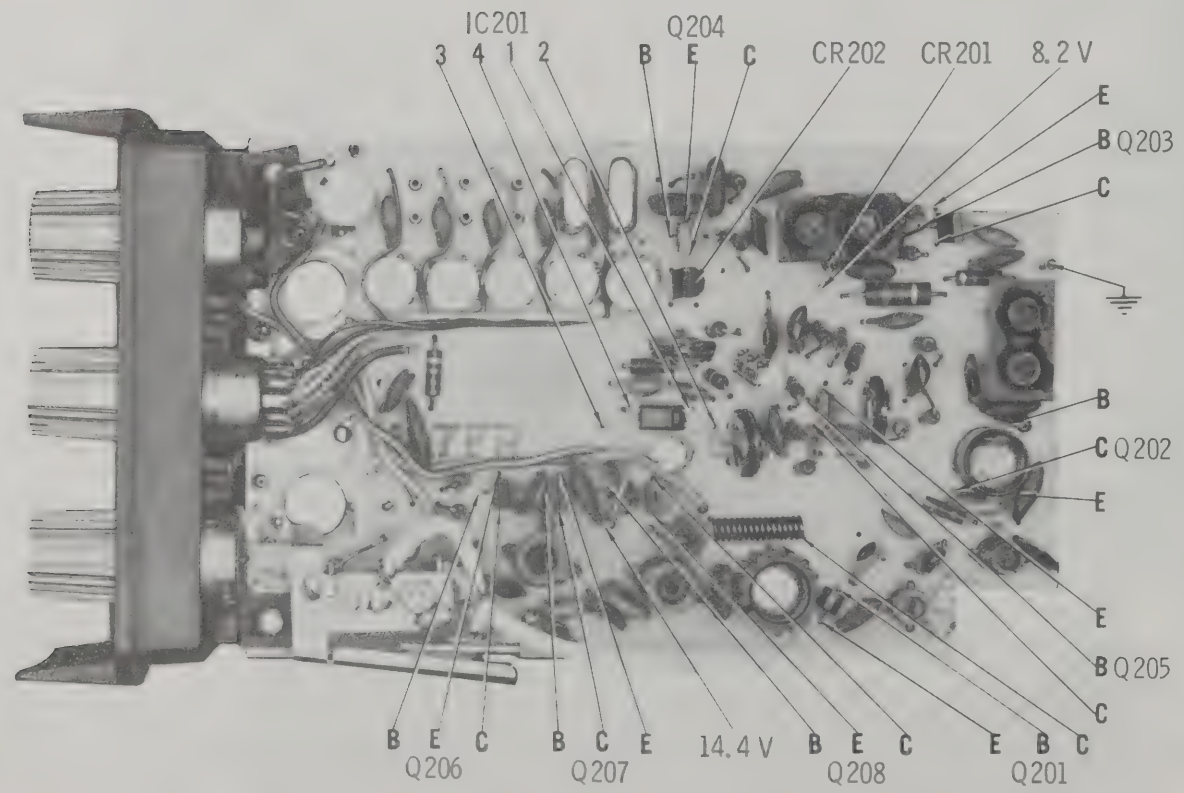


Fig. 12. Transistor Terminal Locations and Voltage Points — Transmitter Board.

PARTS LIST

Item	Description	Part No.

RECEIVER PRINTED BOARD ASSEMBLY (501-122)

RESISTORS

All resistors are ±10%, 1/4 Watt, unless otherwise noted.

R101	27K	4701-0273-042
R102	3.9K	4701-0392-042
R103	820 ohm	4701-0821-042
R104	680 ohm	4701-0681-042
R105	1K	4701-0102-042
R106	330 ohm	4701-0331-042
R107	39K	4701-0393-042
R108	10K	4701-0103-042
R109	180 ohm	4701-0181-042
R110	22K	4701-0223-042
R111	47K	4701-0473-042
R112	1.8K	4701-0182-042
R113	6.8K	4701-0682-042
R114	2.2K	4701-0222-042
R115	2.7K	4701-0272-042
R116	220 ohm	4701-0221-042
R117	33 ohm	4701-0330-042
R118	47K	4701-0473-042
R119	270K	4701-0274-042
R120	4.7K	4701-0472-042
R121	8.2K	4701-0822-042
R122	39K	4701-0393-042
R123	10K	4701-0103-042
R124	5.6K	4701-0562-042
R125	2.2K	4701-0222-042
R126	100 ohm	4701-0101-042
R127	10K	4701-0103-042
R128	10K	4701-0103-042
R129	10K	4701-0103-042
R130	2.2K	4701-0222-042
R131	180 ohm	4701-0181-042
R132	15K	4701-0153-042
R133	5.6K	4701-0562-042
R134	5.6K	4701-0562-042
R135	820 ohm	4701-0821-042
R136	33K	4701-0333-042
R137	68K	4701-0683-042
R138	100K	4701-0104-042
R139	2.2K	4701-0222-042
R140	2.2K	4701-0222-042
R141	100 ohm	4701-0101-042
R142	10K	4701-0103-042
R143	1K	4701-0102-042
R144	6.8K	4701-0682-042
R145	2.2K	4701-0222-042
R146	5.6K	4701-0562-042
R147	100 ohm	4701-0101-042

CAPACITORS

C100	2.7 pf, ±.25 pf, NPO, 500V (Disc)	1500-0279-205
C101	5.6 pf, 10%, NPO, 500V (Disc)	1500-0569-905
C102	.001 mfd, +8-2%, 50V (Disc)	1503-0102-003
C103	4.7 pf, 10%, NPO, 500V (Disc)	1500-0479-905
C104	5.6 pf, 10%, NPO, 500V (Disc)	1500-0569-905
C105	.68 pf, 10% (Composition)	1510-0688-900
C106	3.9 pf, 10%, NPO, 500V (Disc)	1500-0399-905
C107	.01 mfd, +80-20%, 50V (Disc)	1503-0103-007
C108	820 pf, 5%, 50V (Mica)	1506-0821-550
C109	270 pf, 5%, 50V (Mica)	1506-0271-550
C110	.01 mfd, +80-20%, 50V (Disc)	1503-0103-007
C111	.01 mfd, +80-20%, 50V (Disc)	1503-0103-007
C112	150 pf, 5%, 50V (Mica)	1506-0151-550
C113	68 pf, 5%, NPO, 50V (Disc)	1524-0680-002
C114	68 pf, 5%, NPO, 50V (Disc)	1524-0680-002
C115	12 pf, 10%, NPO, 500V (Disc)	1500-0120-605
C116	.001 mfd, +80-20%, 50V (Disc)	1503-0102-003
C117	120 pf, 5%, 50V (Mica)	1506-0121-550
C118	120 pf, 5%, 50V (Mica)	1506-0121-550
C119	.47 pf, -10% (Composition)	1510-0478-900
C120	.01 mfd, +80-20%, 50V (Disc)	1503-0103-007
C121	68 pf, 5%, NPO, 50V (Disc)	1524-0680-002
C122	.01 mfd, 10%, 100V (Mylar Film)	1508-0103-610
C123	.2 mfd, +80-20%, 12V (Disc)	1502-0204-006
C124	180 pf, 5%, 50V (Mica)	1506-0181-550
C125	390 pf, 5%, 50V (Mica)	1506-0391-550
C126	.001 mfd, +80-20%, 50V (Disc)	1503-0102-003
C127	.01 mfd, +80-20%, 50V (Disc)	1503-0103-007
C128	.001 mfd, +80-20%, 50V (Disc)	1503-0102-003
C129	.2 mfd, +80-20%, 12V (Disc)	1502-0204-006
C130	150 pf, 5%, 50V (Mica)	1506-0151-550
C131	.2 mfd, +80-20%, 12V (Disc)	1502-0204-006
C132	.2 mfd, +80-20%, 12V (Disc)	1502-0204-006
C133	33 pf, 10%, NPO, 50V (Disc)	1500-0330-650
C134	.002 mfd, ±20%, 50V (Disc)	1523-0202-002
C135	68 pf, 5%, NPO, 50V (Disc)	1524-0680-002
C136	.047 mfd, 10%, 100V (Mylar Film)	1508-0473-610
C137	.01 mfd, +80-20%, 50V (Disc)	1503-0103-007
C138	470 pf, 5%, 50V (Mica)	1506-0471-550
C139	.015 mfd, 10%, 100V (Mylar Film)	1508-0153-610
C140	.002 mfd, ±20%, 50V (Disc)	1523-0202-002
C141	.047 mfd, 10%, 100V (Mylar Film)	1508-0473-610
C142	5 mfd, 50V, 85°C. (Electrolytic)	1513-0050-004
C143	.1 mfd, 20%, 12V (Disc)	1502-0104-005
C144	.047 mfd, 10%, 100V (Mylar Film)	1508-0473-610
C145	.047 mfd, 10%, 100V (Mylar Film)	1508-0473-610
C146	50 mfd, 16V, 85°C. (Electrolytic)	1513-0500-002
C147	50 mfd, 16V, 85°C. (Electrolytic)	1513-0500-002
C148	.01 mfd, 10%, 100V (Mylar Film)	1508-0103-610
C149	.001 mfd, +80-20%, 50V (Disc)	1503-0102-003
C150	10 mfd, 16V, 85°C. (Electrolytic)	1513-0100-002
C151	.001, +80-20%, 50V (Disc)	1503-0102-003
C152	50 mfd, 16V, 85°C. (Electrolytic)	1513-0500-002
C153	100 mfd, 16V, 85°C. (Electrolytic)	1513-0101-002
C154	.001 mfd, +80-20%, 50V (Disc)	1503-0102-003
C155	1 mfd, 16V, 85°C. (Electrolytic)	1513-0010-002
C156	10 mfd, 16V, 85°C. (Electrolytic)	1513-0100-002
C157	.01 mfd, +80-20%, 50V (Disc)	1503-0103-007
C158	.01 mfd, +80-20%, 50V (Disc)	1503-0103-007
C159	36 pf, 10%, NPO (Disc)	1500-0360-650
C160	15 pf, 10%, NPO, 500V (Disc)	1500-0150-605

COILS

L100	Antenna (Yellow)	1800-5100-504
L101	RF Input (Orange)	1800-5100-503
L102	RF Output (Purple)	1800-5100-517
L103	Mixer Input (Yellow)	1800-5100-504
L104	Mixer Output (Red)	1800-5100-402
L105	Oscillator (Orange)	1800-5100-503
L106	Oscillator Emitter	1801-1236-900
L107	Choke, 3.3 μhy, Shielded	1802-0339-007
L108	Choke, 820 μhy, Shielded	1803-3182-700
L109	Choke, 820 μhy, Shielded	1803-3182-700
L110	Quad Detector	1800-3218-800

FILTERS

CF101	IF, 10.7 MHz	2700-3209-600
CF102	IF, 455 KHz	2700-0000-007

DIODES

CR101	Silicon, 1N4148	4805-1241-200
CR102	Silicon, 1N4148	4805-1241-200
CR103	Silicon, 1N4148	4805-1241-200
CR104	Zener, 9.1V, 5%	4808-0000-015

IC CIRCUITS

IC101	IF, 10.7 MHz	3130-3167-901
IC102	Detector, 455 KHz	3130-3157-603

TRANSISTORS

Q101	Silicon, NPN (RT)	4801-0000-035
Q102	Junction, Field Effect	4811-0000-010
Q103	Silicon, NPN, Lo Beta	4801-0000-100
Q104	Silicon, NPN	4801-0000-010
Q105	Silicon, NPN	4801-0000-010
Q106	Silicon, NPN (WT)	4801-0000-060
Q107	Silicon, NPN	4801-0000-010
Q108	Silicon, NPN	4801-0000-010
Q109	Silicon, NPN	4801-0000-010
Q110	Silicon, NPN (WT)	4801-0000-060
Q111	Silicon, NPN (WT)	4801-0000-060
Q112	Silicon, NPN	4801-0000-005
Q113	Silicon, NPN	4801-0000-005
Q114	Silicon, NPN	4801-0000-005
	WT = White Top RT = Red Top	

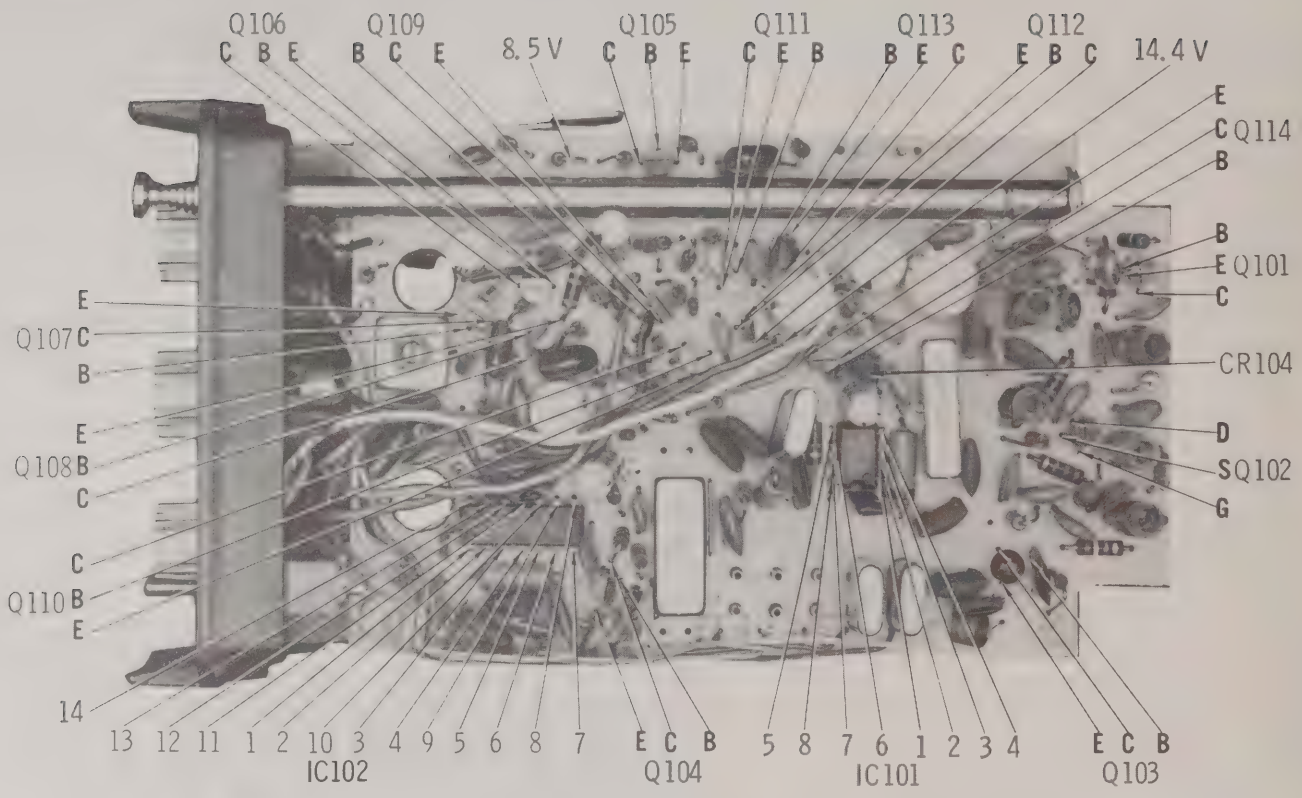


Fig. 11. Transistor Terminal Locations and Voltage Points — Receiver Board.

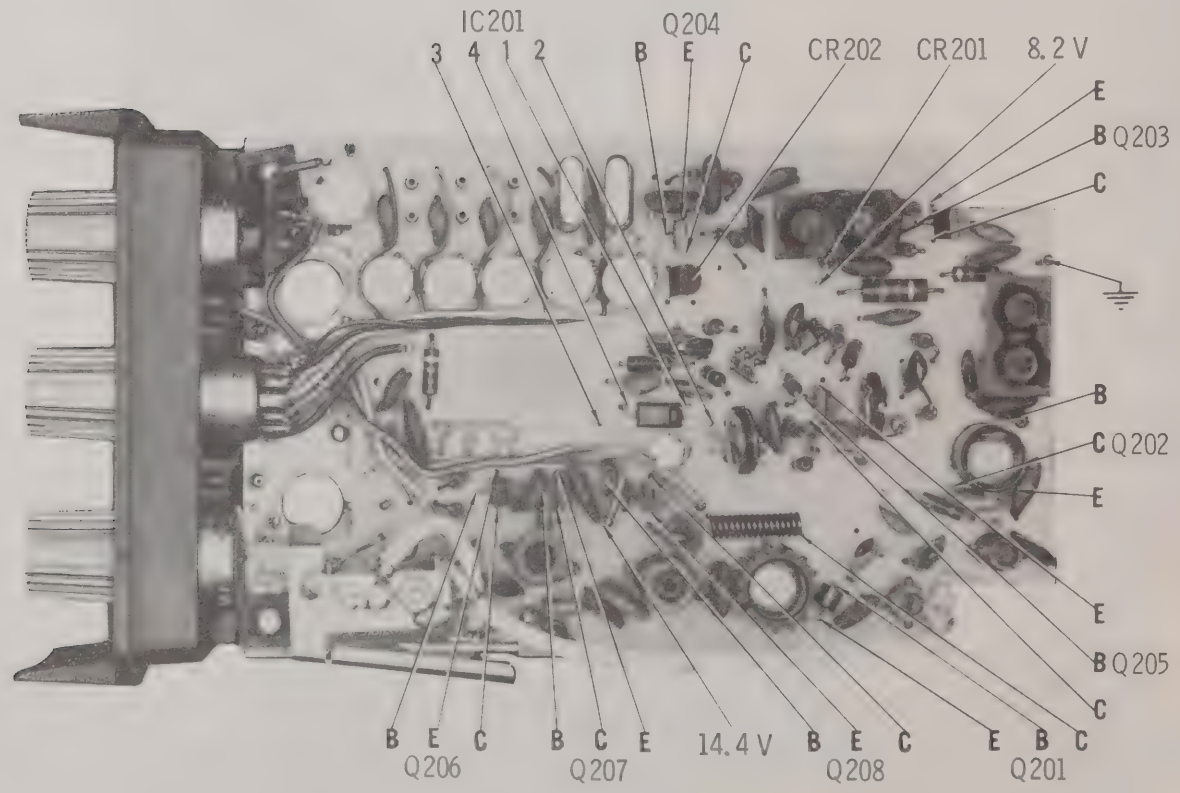
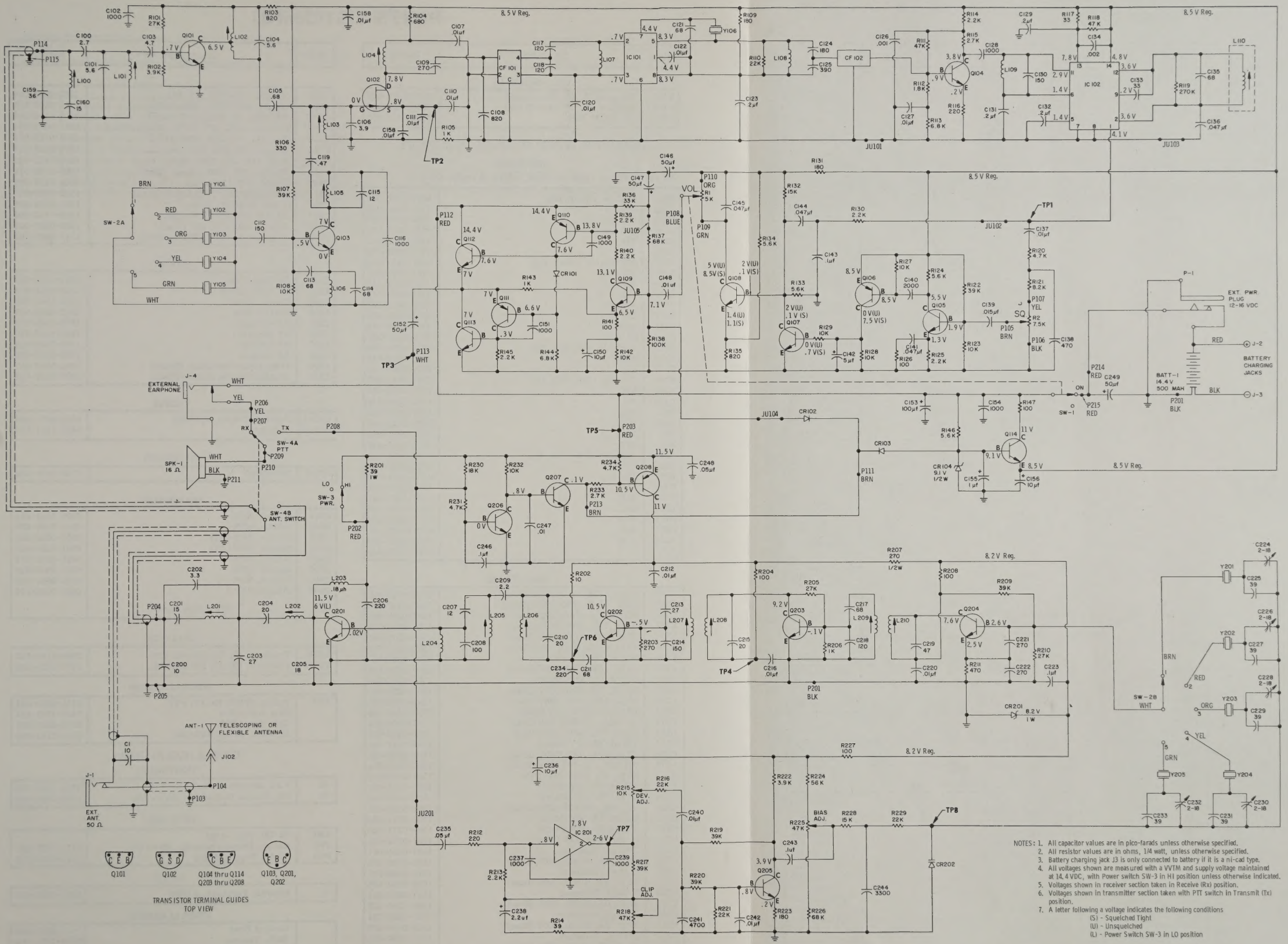


Fig. 12. Transistor Terminal Locations and Voltage Points — Transmitter Board.



NOTES:
1. All capacitor values are in pico-farads unless otherwise specified.
2. All resistor values are in ohms, 1/4 watt, unless otherwise specified.
3. Battery charging jack J3 is only connected to battery if it is a ni-cad type.
4. All voltages shown are measured with a VVTM and supply voltage maintained at 14.4 VDC, with Power switch SW-3 in HI position unless otherwise indicated.
5. Voltages shown in receiver section taken in Receive (Rx) position.
6. Voltages shown in transmitter section taken with PTT switch in Transmit (Tx) position.
7. A letter following a voltage indicates the following conditions
   (S) - Squelched Tight
   (U) - Unsquelched
   (L) - Power Switch SW-3 in LO position

Fig. 13. Aquacom I Schematic.

PARTS LIST(Cont'd.)

Item	Description	Part No.

CRYSTALS

Y101	Receive, Ch. 06, 156.300 MHz	2310-0156-300
Y102	Receive, Ch. 16, 156.800 MHz	2310-0156-800
Y106	IF, 10.245 MHz	2301-3151-601

TRANSMITTER PRINTED BOARD ASSEMBLY (501-121)

RESISTORS

All resistors are ±10%, 1/4 Watt, unless otherwise noted.

R201	39 ohm, 1 Watt, 10%	4701-0390-045
R202	10 ohm	4701-0100-042
R203	270 ohm	4701-0271-042
R204	100 ohm	4701-0101-042
R205	27K	4701-0273-042
R206	1K	4701-0102-042
R207	270 ohm, 1/2 Watt, 10%	4701-0271-044
R208	100 ohm	4701-0101-042
R209	39K	4701-0393-042
R210	27K	4701-0273-042
R211	470 ohm	4701-0471-042
R212	220 ohm	4701-0221-042
R213	2.2K	4701-0222-042
R214	39 ohm	4701-0390-042
R215	Variable, 10K, Dev. Adj.	4751-0103-002
R216	22K	4701-0223-042
R217	39K	4701-0393-042
R218	Variable, 47K, Clip Adj.	4751-0473-002
R219	39K	4701-0393-042
R220	39K	4701-0393-042
R221	22K	4701-0223-042
R222	3.9K	4701-0392-042
R223	180 ohm	4701-0181-042
R224	56K	4701-0563-042
R225	Variable, 47K, Bias Adj.	4751-0473-002
R226	68K	4701-0683-042
R227	100 ohm	4701-0101-042
R228	15K	4701-0153-042
R229	22K	4701-0223-042
R230	18K	4701-0183-042
R231	4.7K	4701-0472-042
R232	10K	4701-0103-042
R233	2.7K	4701-0272-042
R234	4.7K	4701-0472-042

CAPACITORS

C200	10 pf, -10%, NPO, 500V (Disc)	1500-0100-605
C201	15 pf, -10%, NPO, 500V (Disc)	1500-0150-605
C202	3.3 pf, 10%, NPO, 500V (Disc)	1500-0339-905
C203	27 pf, 10%, NPO, 500V (Disc)	1500-0270-605
C204	20 pf, 10%, NPO, 500V (Disc)	1500-0200-605
C205	18 pf, -10%, NPO, 500V (Disc)	1500-0180-605
C206	220 pf, 5%, 50V (Mica)	1506-0221-550
C207	12 pf, 10%, NPO, 500V (Disc)	1500-0120-605
C208	100 pf, 5%, 50V (Mica)	1506-0101-550
C209	2.2 pf, 10% NPO, 500V (Disc)	1500-0229-905
C210	20 pf, 10%, NPO, 500V (Disc)	1500-0200-605
C211	68 pf, 5%, NPO, 50V (Disc)	1524-0680-002
C212	.01 mfd, +80-20%, 25V (Disc)	1502-0103-004
C213	27 pf, 10%, NPO, 500V (Disc)	1500-0270-605
C214	150 pf, 5%, 50V (Mica)	1506-0151-550
C215	20 pf, 10%, NPO, 500V (Disc)	1500-0200-605
C216	.01 mfd, +80-20%, 25V (Disc)	1502-0103-004
C217	68 pf, 5%, NPO, 50V (Disc)	1524-0680-002
C218	120 pf, 5%, 50V (Mica)	1506-0121-550
C219	47 pf, 5%, 50V (Mica)	1506-0470-550
C220	.01 mfd, +80-20%, 25V (Disc)	1502-0103-004
C221	270 pf, 5%, 50V (Mica)	1506-0271-550
C222	270 pf, 5%, 50V (Mica)	1506-0271-550
C223	.1 mfd, 20%, 12V (Disc)	1502-0104-005
C224	2-18 pf, Trimmer	1517-0000-001
C225	39 pf, 5%, N1500, 500V (Disc)	1525-0390-505
C226	2-18 pf, Trimmer	1517-0000-001
C227	39 pf, 5%, N1500, 500V (Disc)	1525-0390-505
C228	2-18 pf, Trimmer	1517-0000-001
C229	39 pf, 5%, N1500, 500V (Disc)	1525-0390-505
C230	2-18 pf, Trimmer	1517-0000-001
C231	39 pf, 5%, N1500, 500V (Disc)	1525-0390-505
C232	2-18 pf, Trimmer	1517-0000-001
C233	39 pf, 5%, N1500, 500V (Disc)	1525-0390-505
C234	220 pf, 5%, 50V (Mica)	1506-0221-550

Item	Description	Part No.

C235	.05 mfd, +80-20%, 25V (Disc)	1502-0503-004
C236	10 mfd, 10V, 85°C. (Electrolytic)	1513-0100-001
C237	.001 mfd, +80-20%, 500V (Disc)	1503-0102-001
C238	2.2 mfd, ±20%, 50V, 85°C. (Electrolytic)	1513-0022-004
C239	.001 mfd, +80-20%, 500V (Disc)	1503-0102-001
C240	.01 mfd, +80-20%, 25V (Disc)	1502-0103-004
C241	.0047 mfd, 10%, 100V (Mylar Film)	1508-0472-610
C242	.01 mfd, 10%, 100V (Mylar Film)	1508-0103-610
C243	.1 mfd, 20%, 12V (Disc)	1502-0104-005
C244	.0033 mfd, 10%, 100V (Mylar Film)	1508-0332-610
C246	.1 mfd, 20%, 12V (Disc)	1502-0104-005
C247	.01 mfd, +80-20%, 25V (Disc)	1502-0103-004
C248	.05 mfd, +80-20%, 25V (Disc)	1502-0503-004
C249	50 mfd, 16V, 85°C. (Electrolytic)	1513-0500-002

COILS

L201	RF Filter (Red)	1800-3152-002
L202	RF Filter (Red)	1800-3152-002
L203	Choke, .18μhy	1803-1281-600
L204	Ferrite Bead	2502-0000-001
L205	RF (Orange)	1800-5100-503
L206	RF (Brown)	1800-5100-510
L207	RF (Green)	1800-5100-508
L208	RF (Green)	1800-5100-508
L209	Transmitter Oscillator (Black)	1800-5100-507
L210	Transmitter Oscillator (Black)	1800-5100-507

DIODES

CR201	Zener, 8.2 Volts, 1N4738A	4808-0000-009
CR202	Varactor	4809-1291-900

IC CIRCUITS

IC201	Modulator	3130-0000-008

TRANSISTORS

Q201	Silicon, NPN	4804-3169-601
Q202	Silicon, NPN	4804-3169-605
Q203	Silicon, NPN (BT)	4801-0000-003
Q204	Silicon, NPN (BT)	4801-0000-003
Q205	Silicon, NPN	4801-0000-013
Q206	Silicon, NPN	4801-0000-010
Q207	Silicon, NPN	4801-0000-010
Q208	Silicon, PNP	4801-0000-135
	BT = Blue Top	

CRYSTALS

Y201	Transmit, Ch. 06, 156.300 MHz	2309-0156-300
Y202	Transmit, Ch. 16, 156.800 MHz	2309-0156-800

MISCELLANEOUS

SW4	Switch, SPDT, Rx-Tx, PTT	5116-0000-001
	Heat Sink, Q201	5400-1285-601
	Heat Sink, Q202	5400-0000-001
	Actuator, Switch SW4A&B	2511-5112-000

CONTROL HEAD ASSEMBLY

CONTROLS

R1	7.5K, Squelch Control	4750-1247-907
R2	5K, Volume Control/On-Off Switch	4750-1247-906

SWITCHES

SW1	On-Off, Part of R2	
SW2	Rotary, Channel Selector, 2P-5 Pos.	5111-1277-100
SW3	Hi-Lo, Toggle, SPDT	5114-0000-002

JACKS

J4	External Earphone, 2.5MM	2101-0000-007

MISCELLANEOUS

	Control Head	1411-6037-400
	Knob, Volume	2402-1231-002
	Knob, Squelch	2402-1231-002
	Knob, Channel Selector	2402-1231-004

PARTS LIST(Cont'd.)

CABINET ASSEMBLY

Item	Description	Part No.
C1	Capacitor, 10 pf, ±10%, NPO, 500V (Disc)	1500-0100-605
J1	Jack, External Antenna, 3.5MM	2101-0000-008
P1	Plug, Coax, Ext. Power	2104-0000-008
SPK1	Speaker, 16 ohm, 2-1/4" Rd.	1301-3213-402
ANT-1	Antenna, Telescoping	1201-5108-801
	Main Casing	1411-7009-400
	Button, Transmit	2402-1270-800
	Grille, Cover (Front)	1411-7009-500

CABINET ASSEMBLY(Cont'd.)

Item	Description	Part No.
	Cover, Rear	1411-6037-500
	Door, Battery	1411-7009-600
	Contact, Battery, Bottom (2 Req'd.)	2107-3205-900
	Contact, Battery, Side (2 Req'd.)	2107-3206-000
	Cable, Coax, RG-188/U	6042-0000-003
	Thumb Screw	2807-1279-700
	Retaining Ring, Thumbscrew	2510-0000-002